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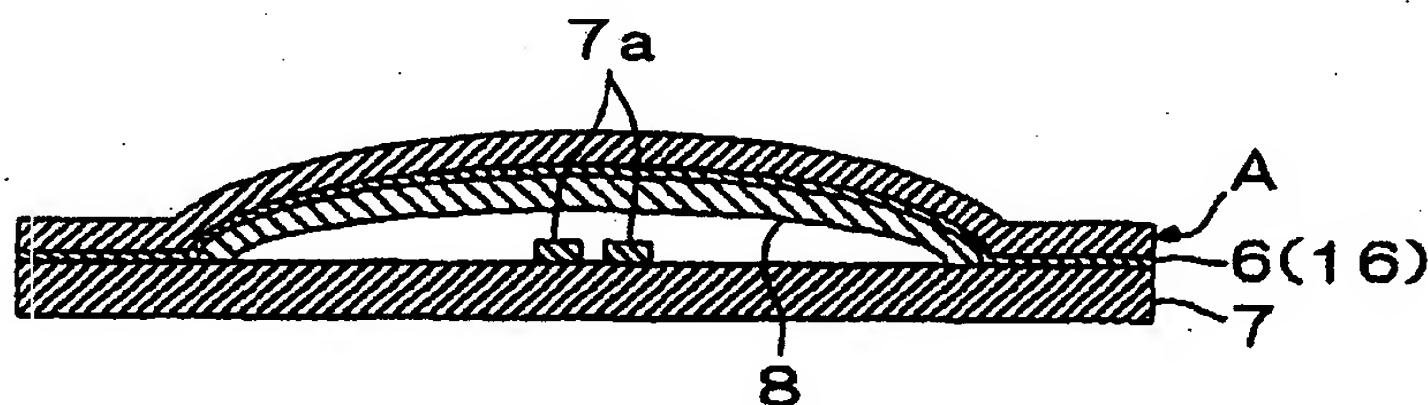
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(54) Light illuminating type switch

(57) To enable to supply a unitized light illuminating type switch in a thinned type and having excellent click feeling by forming a movable contact and an electroluminescent sheet in an integrated structure by attachedly pasting together the movable contact and the electroluminescent sheet, fixed contacts 7a are provided on a switch sheet, a movable contact 8 capable of electrically

connecting to the switch sheet by being elastically deformed is arranged above the switch sheet and a flexible electroluminescent sheet A is attachedly pasted to a surface of the movable contact 8 by interposing an insulating member 5 as far as a peripheral portion thereof other than the movable contact 8.

FIG.2



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electroluminescent sheet and the movable contact.

[0013] Further, preferably, the movable contact may be a metal member formed in a dome shape.

[0014] Further, the metal member formed in the dome shape may be formed in a net-like shape.

[0015] Further, preferably, the electroluminescent sheet and the movable contact may be attachedly pasted together by the adhesive material or the sheet attached with the both face adhesive material interposed between the electroluminescent sheet and the surface of the movable contact and the adhesive material or the sheet attached with the both face adhesive material may be interposed between the electroluminescent sheet and 80 % or less of an arc-like portion of the surface of the movable contact.

[0016] Further, the electroluminescent sheet may previously be molded or plastically deformed to constitute a shape in line with a shape of the movable contact.

[0017] Further, the electroluminescent sheet may be formed by successively laminating a transparent electrode layer, a luminescent layer, an insulating layer and a rear electrode layer on a flexible transparent film and at least one layer of the luminescent layer, the insulating layer and the rear electrode layer may be omitted at a portion of the electroluminescent sheet disposed above a surface portion of the movable contact.

[0018] Further, it is preferable to arrange a key operating pad above the electroluminescent sheet.

[0019] Further, it is preferable that the key operating pad is formed in a sheet-like shape.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020]

Fig. 1 is a sectional view showing a basic structure of an electroluminescent sheet used in the invention;

Fig. 2 is a sectional view showing a structure of a light illuminating type switch according to the invention;

Fig. 3 is a sectional view of an electroluminescent sheet previously molded in a shape in line with a shape of a movable contact;

Fig. 4 is a sectional view of an electroluminescent sheet formed by omitting a luminescent layer, an insulating layer and a rear electrode layer;

Fig. 5 is a sectional view showing an example of attachedly pasting together a movable contact and an electroluminescent sheet such that an adhesive material or a sheet attached with a both face adhesive material is interposed therebetween only at a portion of a surface of the movable contact;

Fig. 6 is a plane view showing a region of the adhesive material or the sheet attached with the both face adhesive material interposed therebetween only at the portion of the surface of the movable contact;

Fig. 7 is a plane view showing other region of the adhesive material or the sheet attached with the both face adhesive material interposed therebetween only at a portion of the surface of the movable contact;

Figs. 8A and 8B are views showing a dome type switch used in the invention in which Fig. 8A is a sectional view and Fig. 8B is a plane view;

Figs. 9A and 9B are views showing an example in which an arc-like portion of the dome type switch is formed in a net-like shape in which Fig. 9A is a sectional view and Fig. 9B is a plane view;

Figs. 10A and 10B are views showing an example of a shape of the dome type switch both ends of which are cut in which Fig. 10A is a sectional view and Fig. 10B is a plane view;

Figs. 11A and 11B are views showing an example of a shape of the dome type switch the arc-like portion of which is formed in the net-like shape and the both ends of which are cut in which Fig. 11A is a sectional view and Fig. 11B is a plane view;

Fig. 12 is a sectional view showing an example in which characters or graphic figures are printed on a surface of an electroluminescent sheet used in a light illuminating type switch according to the invention;

Fig. 13 is a sectional view showing an example in which a key operating pad is provided to the light illuminating type switch according to the invention;

Fig. 14 is a sectional view showing an example in which a key operating pad in a sheet-like shape is provided to a light illuminating type switch according to the invention;

Fig. 15 is a sectional view showing a conventional example in which LED is used as a light source of a light illuminating type switch; and

Fig. 16 is an explanatory view for explaining parameters used in calculating a click rate of a dome type switch.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0021] An explanation will be given of embodiments of the invention in reference to the drawings. An explanation will be given of an electroluminescent sheet A used in the invention in reference to Fig. 1. A transparent electrode layer 1 is constituted by vapor-depositing indium tin oxide (hereinafter, referred to as "ITO") constituting a transparent elec-

artificially provided a portion in which the adhesive material 6 or the sheet 16 attached with the both face adhesive material is not interposed on the surface of the movable contact 8 and accordingly, although the movable contact 8 is attachedly pasted on the electroluminescent sheet, a nonadhering portion N is also present.

[0031] Further, when the adhesive material is coated or the sheet 16 attached with the both face adhesive material is interposed only at a portion of the surface of the movable contact 8, in Fig. 5, there is shown the example in which the adhesive material is coated or the sheet 16 attached with the both face adhesive material is interposed only at a portion except a peripheral edge portion (that is, the nonadhering portion N) of the surface of the movable contact 8. However, the invention is not limited thereto but, otherwise, there are pointed out a case in which the adhesive material 6 or the sheet 16 attached with the both face adhesive material is interposed only at a central portion of the movable contact 8 as shown by Fig. 6, further, a case in which the adhesive material 6 or the sheet 16 attached with the both face adhesive material is interposed to constitute a bridge over the surface of the movable contact 8 as shown by Fig. 7.

[0032] Here, an explanation will be given of the dome type switch used in the embodiment as the movable contact 8 (refer to Figs. 8A and 8B). The movable contact 8 is made of a metal of stainless steel or phosphor bronze as its material and is a part which can be deformed elastically and the part is brought into a recessed state by being elastically deformed when the part is pushed by, for example, the finger of a person and recovers to the original shape when the finger is detached. The movable contact 8 is brought into contact with the pair of fixed contacts 7a in the state in which the movable contact 8 is elastically deformed to recess and the pair of fixed contacts 7a is brought into an electrically connected state.

[0033] There is constituted a difference in the click feeling when the switch is operated between a case (case of Fig. 2) in which the adhesive material 6 or the sheet 16 attached with the both face adhesive material is interposed and the movable contact 8 is attachedly pasted to the electroluminescent sheet such that the total of the surface of the movable contact 8 is attachedly pasted thereto, and a case (case of Fig. 5) in which the movable contact 8 is attachedly pasted to the electroluminescent sheet such that the adhesive agent 6 or the sheet 16 attached with the both face adhesive material is interposed only at a portion of the surface of the movable contact 8. An explanation will be given of a result of quantitatively measuring the difference.

[0034] Generally, the click feeling of the dome type switch of this kind is represented by a value shown below.

$$\text{Click rate (\%)} = (\text{OF: Operating force} - \text{RF: Return force}) / (\text{OF: Operating force}) \times 100$$

[0035] In the above equation, "OF: Operating force" designates a maximum value of force necessary for deforming the dome type switch from the dome type shape to a shape for electrically connecting the pair of fixed contacts of the switch sheet disposed at a lower portion (pushed-in state) and "RF: Return force" designates a value of force at a time point at which the dome type switch reaches a shape by which the pair of fixed contacts of the switch sheet are electrically connected (refer to Fig. 16). Further, the click rate is felt to be excellent when a result of the above-described calculation is 50 % \pm 10 %. In this case, when the movable contact 8 shown by Figs. 8A and 8B is used, there are provided results of measurement in which click rates are respectively 49 %, 43 % and 15 % respectively for a case of a single member of the movable contact 8 (dome type switch), a case in which the electroluminescent sheet is attachedly pasted such that the adhesive material 6 or the sheet 16 attached with the both face adhesive material is interposed only at a portion of the surface of the movable contact 8 and a case in which the adhesive material 6 is coated or the sheet 16 attached with the both face adhesive material is interposed to attachedly paste the movable contact 8 on the electroluminescent sheet such that the total of the surface of the movable contact 8 is attachedly pasted thereto. That is, excellent click feeling may be regarded to achieve for the case in which the electroluminescent sheet and the movable contact 8 are attachedly pasted together such that the adhesive material 6 or the sheet 16 attached with the both face adhesive material is interposed therebetween only at a portion of the surface of the movable contact 8.

[0036] Although in the above-described, there is exemplified the shape of the dome type switch constituting the movable contact 8 shown by Figs. 8A and 8B, the dome type switch of the movable contact 8 is not limited thereto. According to the light illuminating type switch of the invention, in correspondence with the specification of the electroluminescent sheet used, there may be used a movable contact 18 in which an arc-like portion of a dome type switch is formed in a net-like shape as shown by Figs. 9A and 9B, or a movable contact 28 in a shape in which both ends of the dome type shown by Figs. 8A and 8B are cut as shown by Figs. 10A and 10B, or a movable contact 38 in a shape in which both ends of the net-like dome type shown by Figs. 9A and 9B are cut as shown by Figs. 11A and 11B to thereby achieve excellent click feeling.

[0037] In Fig. 13, there is shown an example in which a key operating pad 10 is arranged for making ON/OFF the movable contact 8 above the electroluminescent sheet of the light illuminating type switch according to the invention. The key operating pad 10 is formed by a material of silicone rubber or the like which is substantially transparent. By providing such a key operating pad 10, further excellent click feeling can be expected. According to the key operating pad 10, different from the case of the conventional LED light source, in the case of the embodiment, the electroluminescent light source is constituted and accordingly, the key operating pad 10 having a large thickness is not used to thereby ena-

of the movable contact.

4. The light illuminating type switch according to Claim 1:
wherein the electroluminescent sheet and the movable contact are attachedly pasted together by a sheet attached
5 with a both face adhesive material interposed between the electroluminescent sheet and the surface of the movable contact.
5. The light illuminating type switch according to Claim 4:
wherein the sheet attached with the both face adhesive material is interposed between the electroluminescent
10 sheet and only a portion of the surface of the movable contact.
6. The light illuminating type switch according to any one of Claims 1 through 5:
wherein the movable contact is a metal member formed in a dome shape.
- 15 7. The light illuminating type switch according to Claim 6:
wherein the metal member formed in the dome shape is formed in a net-like shape.
8. The light illuminating type switch according to any one of Claims 1 through 7:
wherein the electroluminescent sheet and the movable contact are attachedly pasted together by the adhesive
20 material or the sheet attached with the both face adhesive material interposed between the electroluminescent sheet and the surface of the movable contact and the adhesive material or the sheet attached with the both face adhesive material is interposed between the electroluminescent sheet and 80 % or less of an arc-like portion of the surface of the movable contact.
- 25 9. The light illuminating type switch according to any one of Claims 1 through 8:
wherein the electroluminescent sheet is previously molded or plastically deformed to be formed in a shape in line with a shape of the movable contact.
- 30 10. The light illuminating type switch according to any one of Claims 1 through 9:
wherein the electroluminescent sheet is formed by successively laminating a transparent electrode layer, a luminescent layer, an insulating layer and a rear electrode layer on a flexible transparent film and at least one layer of the luminescent layer, the insulating layer and the rear electrode layer is omitted at a portion of the layer disposed above a surface portion of the movable contact.
- 35 11. The light illuminating type switch according to any one of Claims 1 through 10:
wherein the key operating pad is arranged above the electroluminescent sheet.
- 40 12. The light illuminating type switch according to Claim 11:
wherein the key operating pad is formed in a sheet-like shape.

FIG.4

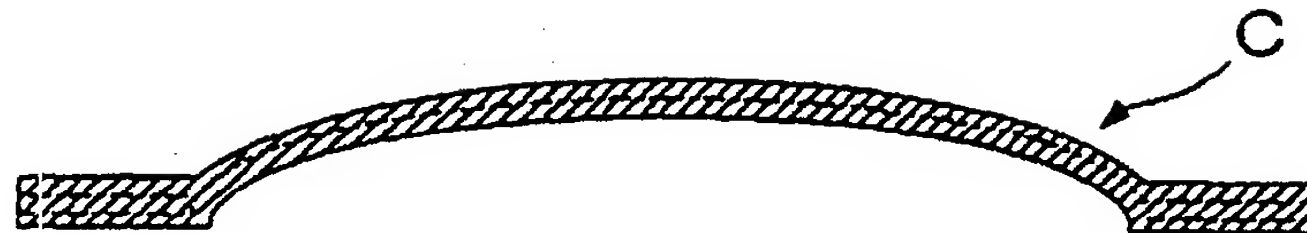


FIG.5

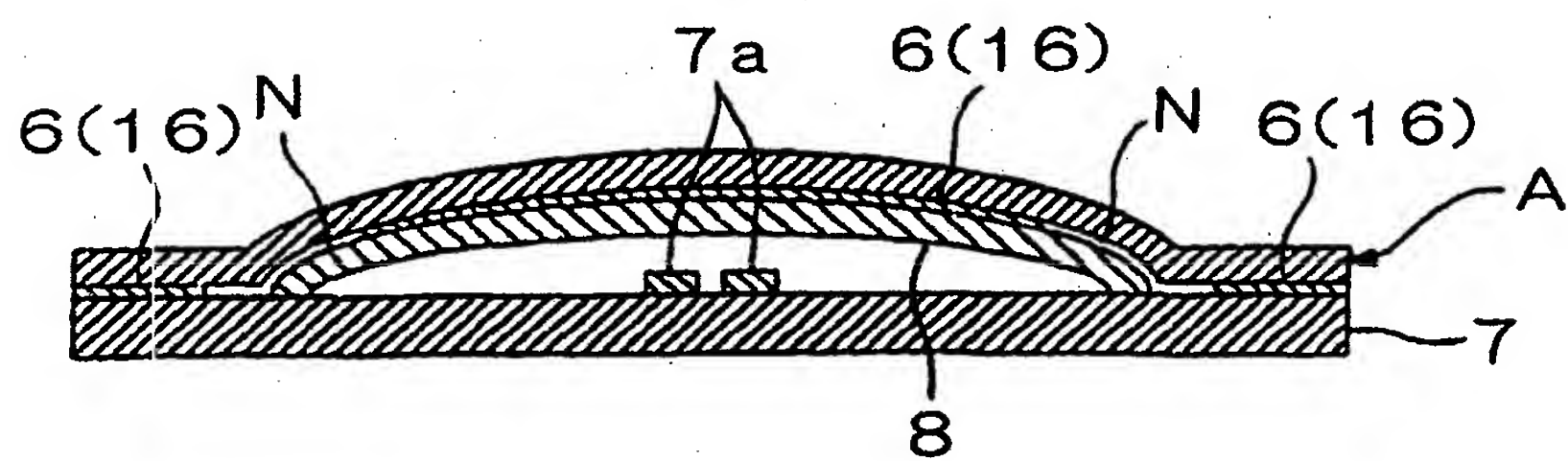


FIG.6

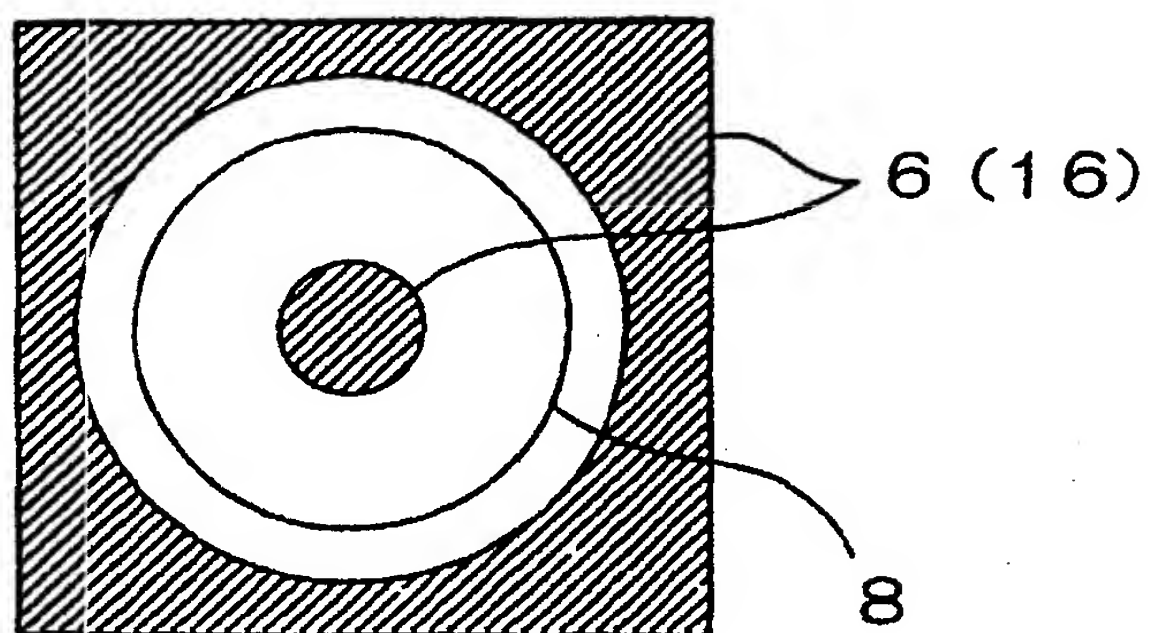


FIG.9

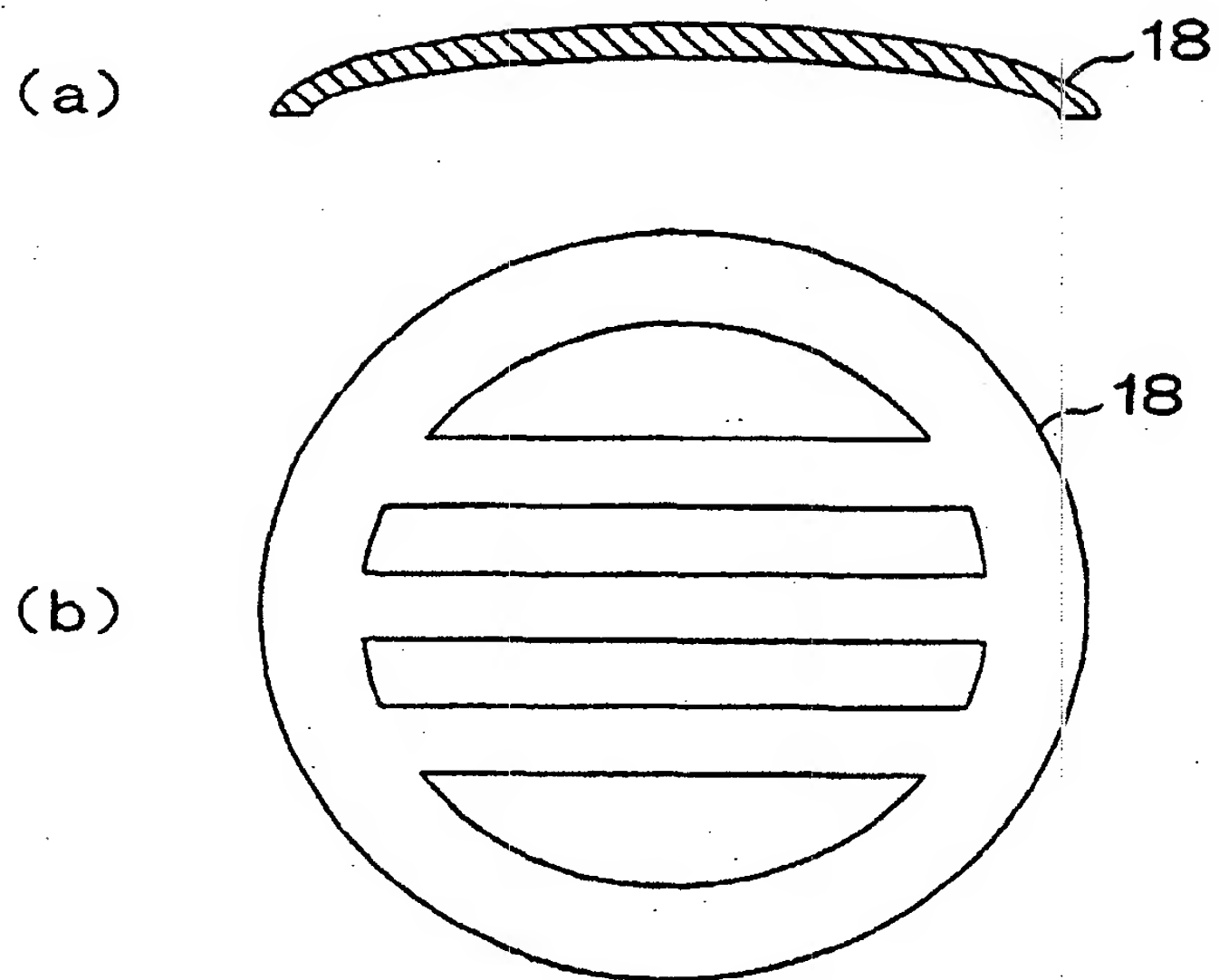


FIG.10

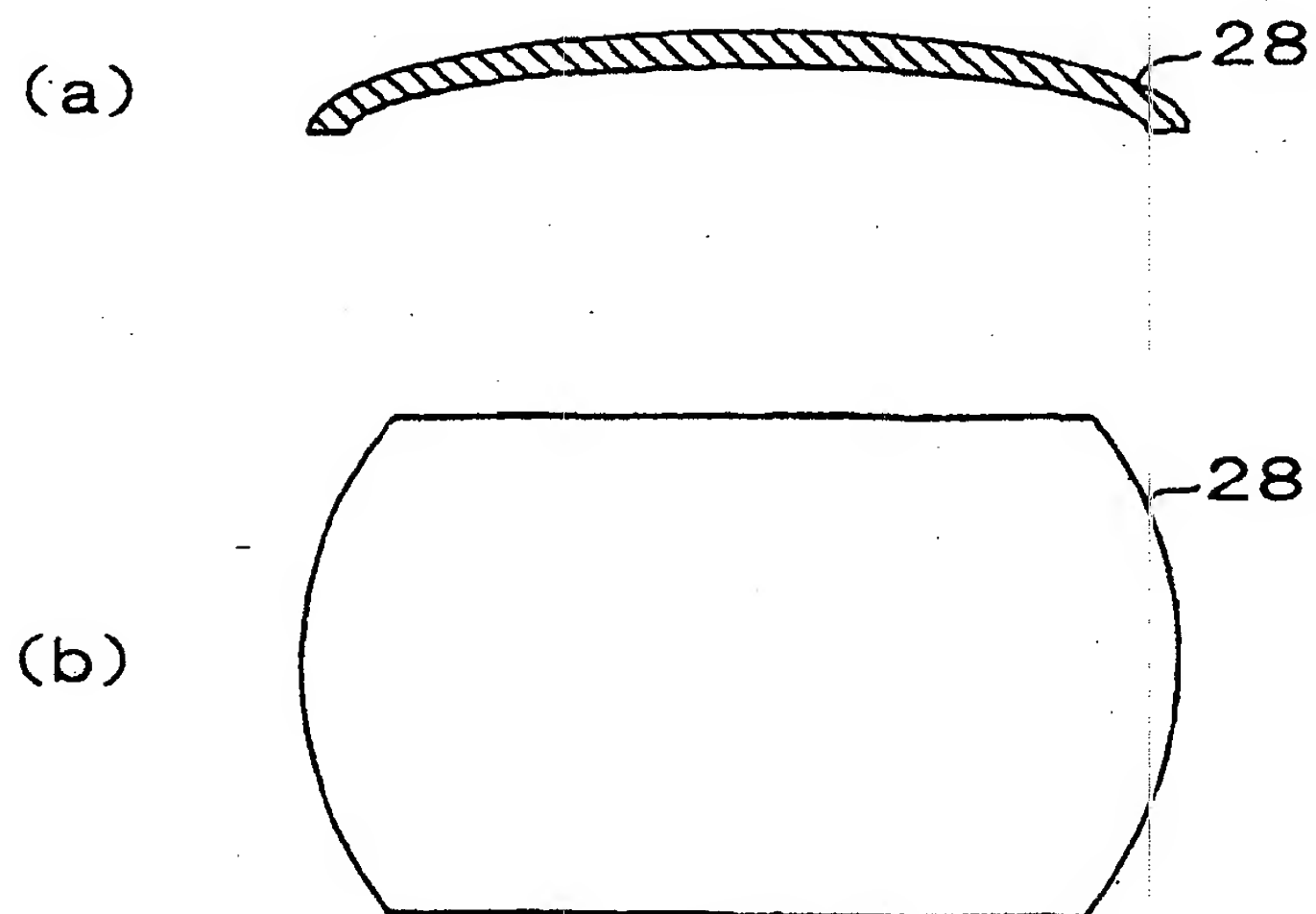


FIG.13

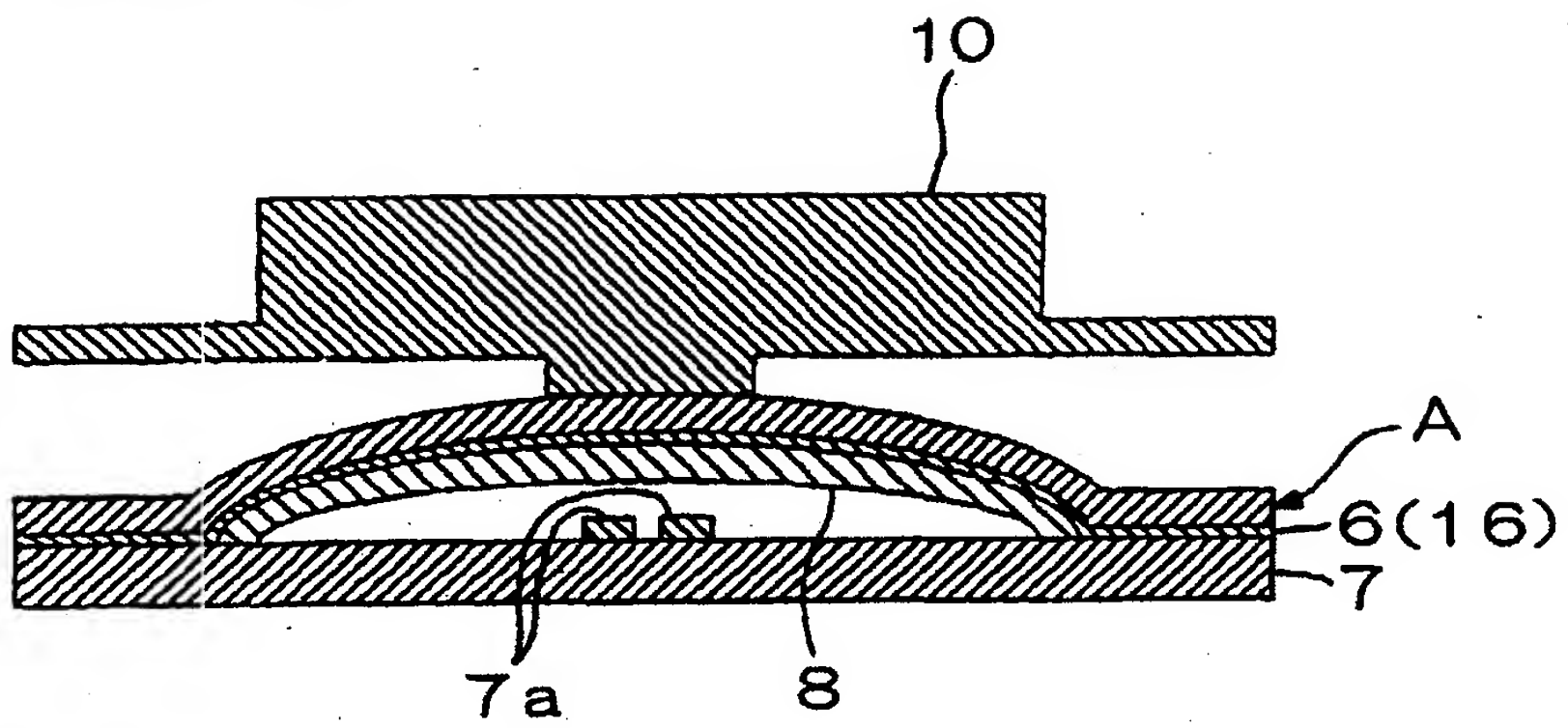


FIG.14

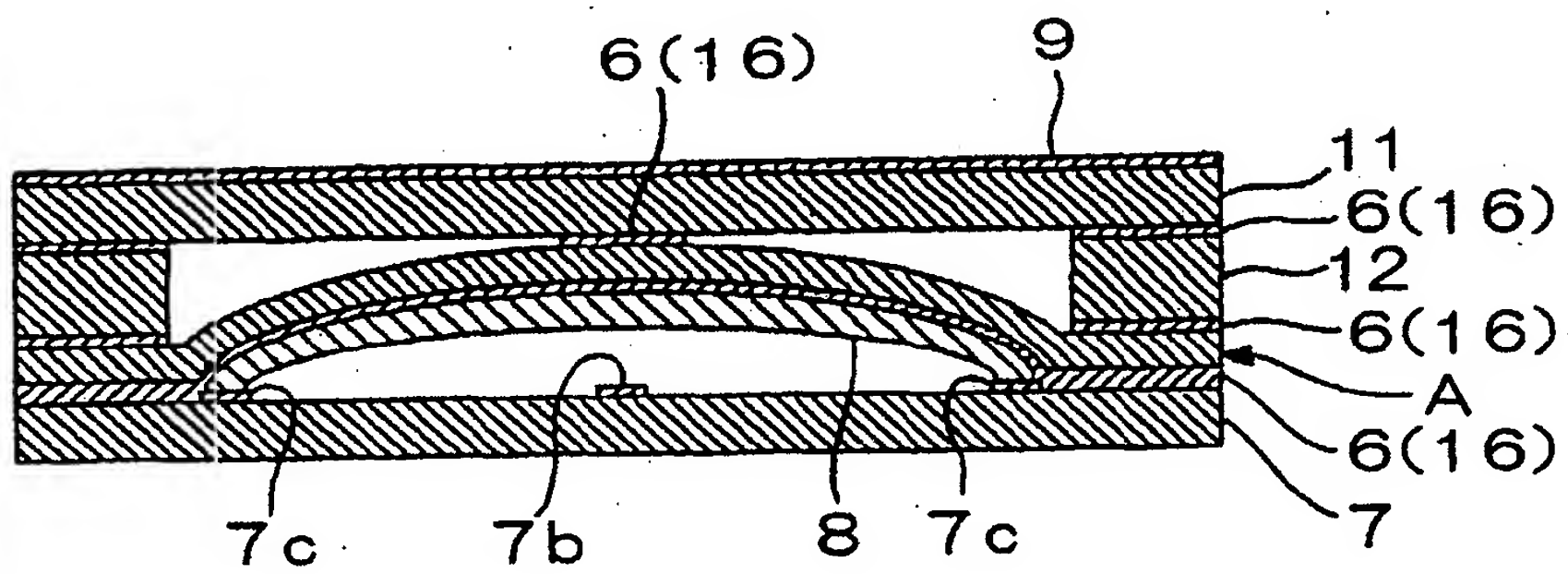
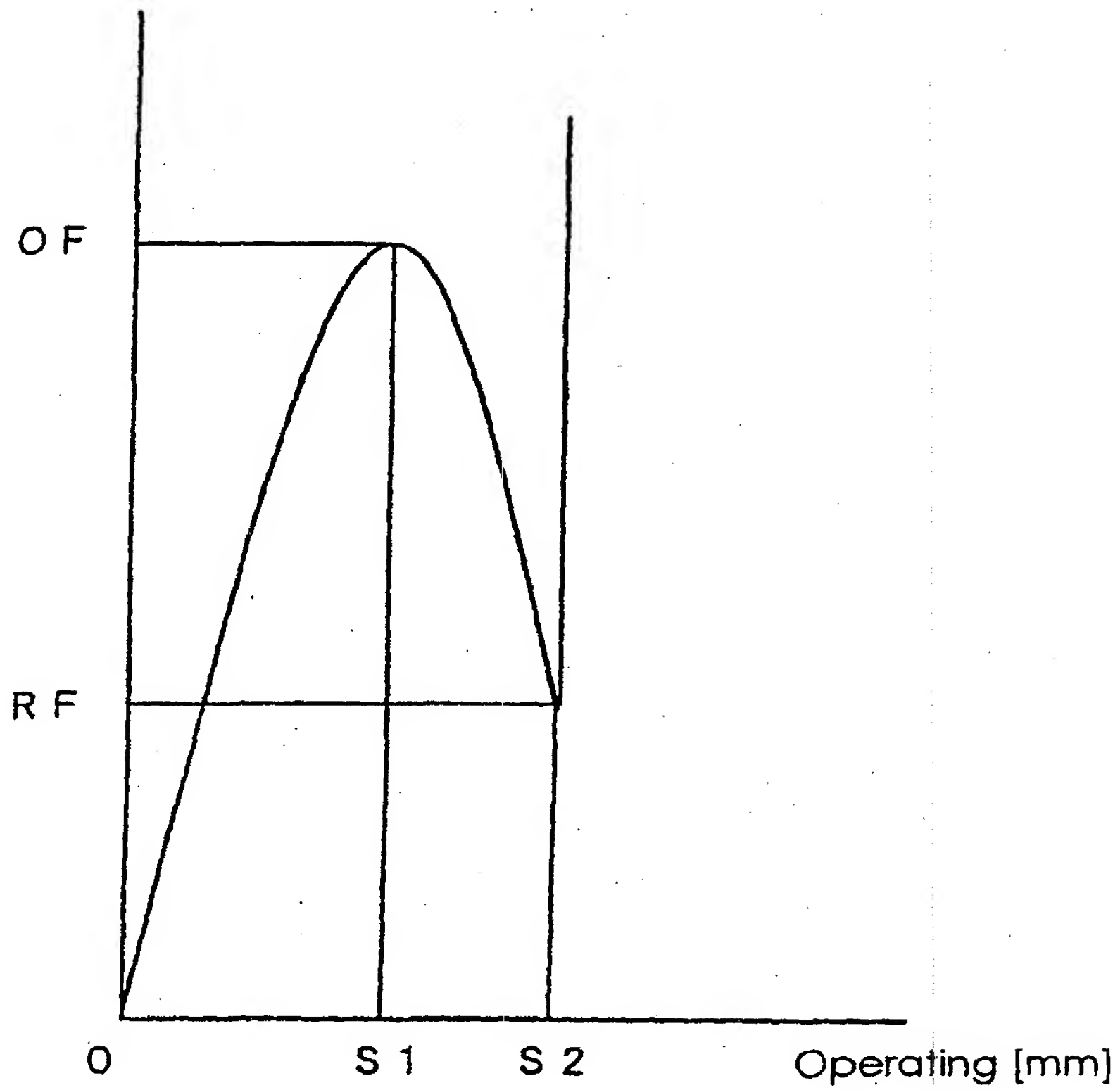


FIG.16

Force [gf]



OF: Operating Force

RF: Return Force

CK: $[(OF - RF) / OF] \times 100$ [%]

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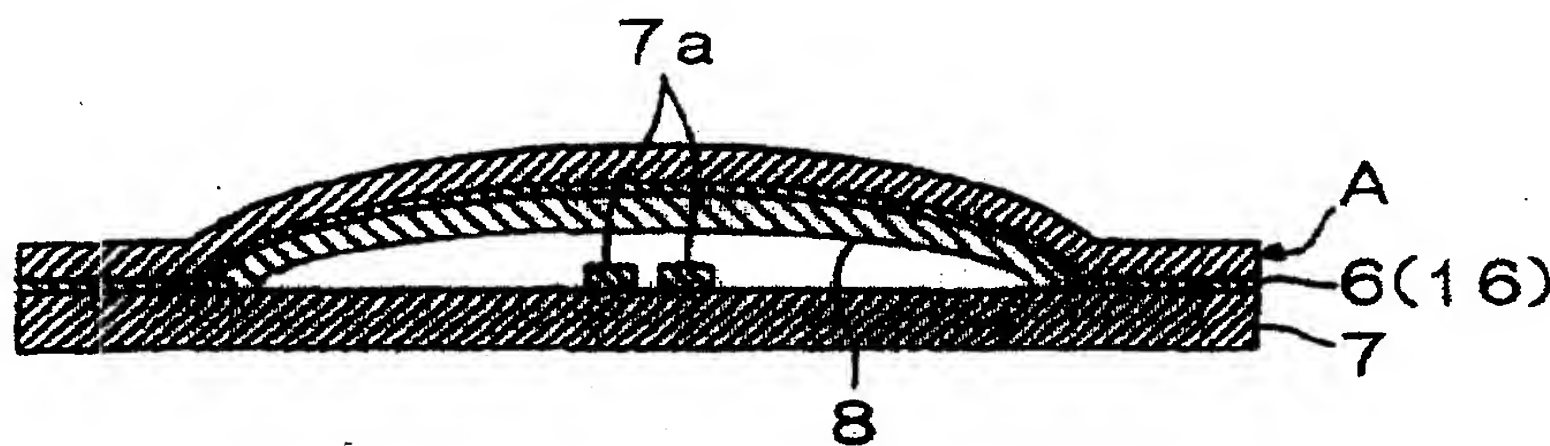
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(54) Light illuminating type switch

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switch sheet, a movable contact 8 capable of electrically connecting to the switch sheet by being elastically deformed is arranged above the switch sheet and a flexible electroluminescent sheet A is attachedly pasted to a surface of the movable contact 8 by interposing an insulating member 5 as far as a peripheral portion thereof other than the movable contact 8.

FIG.2



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European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 00 10 5112

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
Y	US 4 812 831 A (LAIER CARL P) 14 March 1989 (1989-03-14) * the whole document *	1-12	
Y	PATENT ABSTRACTS OF JAPAN vol. 1997, no. 08, 29 August 1997 (1997-08-29) & JP 09 106729 A (MATSUSHITA ELECTRIC IND CO LTD), 22 April 1997 (1997-04-22) * abstract *	1-12	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 12 February 2002	Examiner Desmet, W
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